

CERES Data Management System

Items for Discussion - June 1999

Implementation Approach

Interface with EDOS and LaRC DAAC

Requirements on ESDIS: Level 0, Ephemeris/Attitude

Schedule

Issues

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Data Management Office

Atmospheric Sciences Research

NASA Langley Research Center

CERES Science Objectives

- For climate change analysis:
 - continue the ERBE (Earth Radiation Budget Experiment) record of radiative fluxes at the top of the atmosphere (TOA)
 - use the same analysis techniques as the existing ERBE data
- Double the accuracy of estimates of radiative fluxes at TOA and Earth's surface
- Provide first long-term global estimates of radiative fluxes within the Earth's atmosphere
- Provide cloud property estimates consistent with the radiative fluxes from surface to TOA

Heritage

ERBE Scanners and Non-scanners

ERBS - October 1984

NOAA 9 - December 1984

NOAA 10 - September 1986

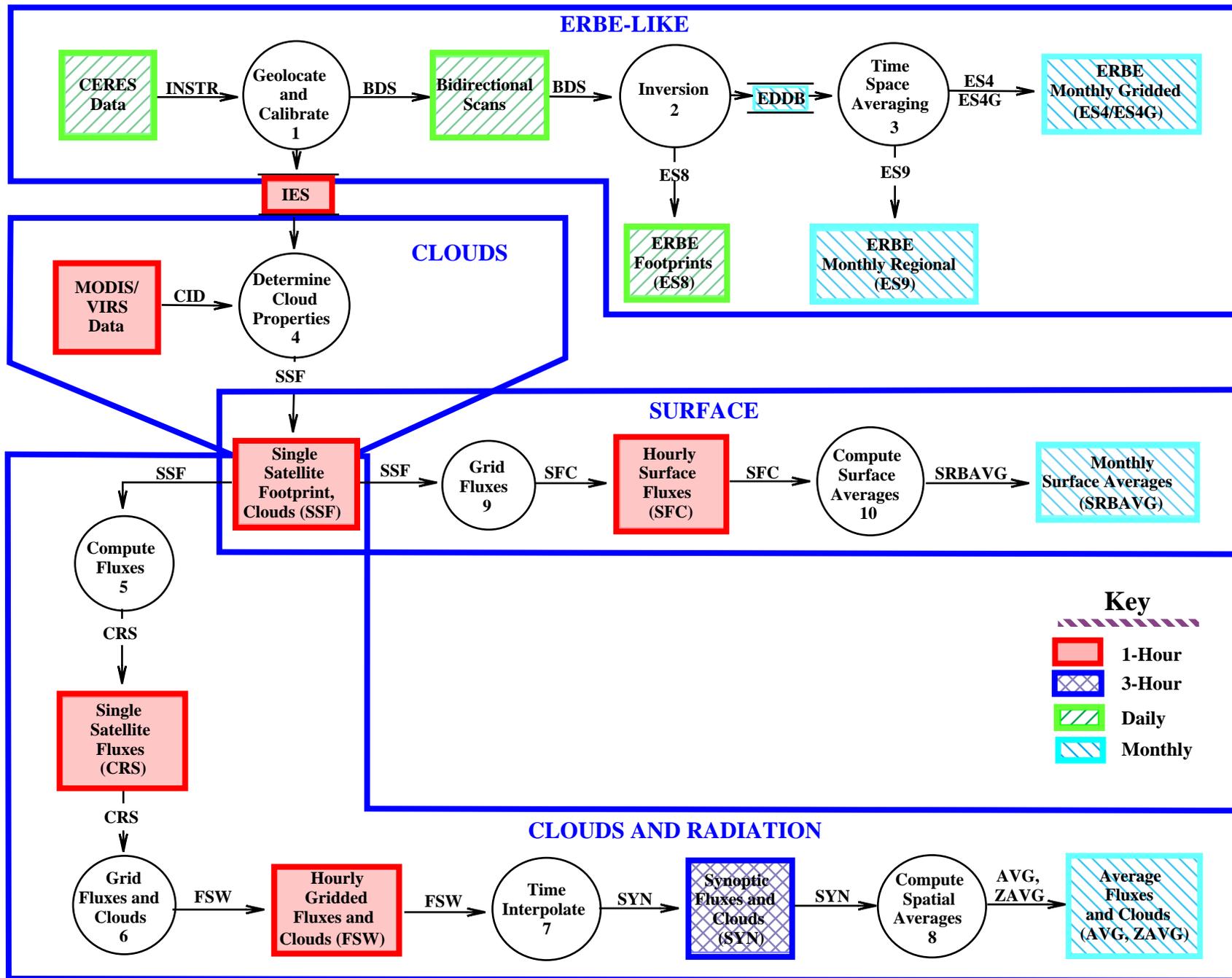
CERES Scanners

TRMM - November 1997

Terra - 1999

EOS PM - 2000

CERES Top Level Data Flow Diagram



Release 2 PGE Size as Delivered to LaRC DAAC - 4/99

Working Group	SS	Delivery Date	Lines of Code (Including Comments)		Software, Bytes			
			Source	Scripts	Source	Scripts	SMF/ PCF	Misc
Instrument	1.0	04/15/99	137500	9800	6460976	400000	24000	3679752
ERBE-like	2.0 & 3.0	04/21/99	65603	7692	2319128	348684	225245	3033940
Clouds	4.1 - 4.3	03/09/99	106894	3922	7794832	283070	122489	124371
	4.4	03/09/99	31543	92	3455528	900	1076	950688
Inversion	4.5 & 4.6	02/26/99	16230	1510	593575	76568	16989	45344
SARB	5.0	03/22/99	32037	1305	1195130	7994	25789	3138
	12.0	02/18/99	15700	8745	539915	50851	27951	83568
TISA	6.0 & 9.0	03/15/99	41782	4523	1472252	178974	217421	135744
	7.1, 8.0, & 10.0	04/01/99	34781	1272	1169127	59385	81961	34792
	11.0	02/25/99	30032	4659	984111	149583	136357	13322
System	CERESlib	02/18/99	124238	2472	4249034	71530	13898	77369
System Total			636340	45992	30233608	1627539	893176	8182028

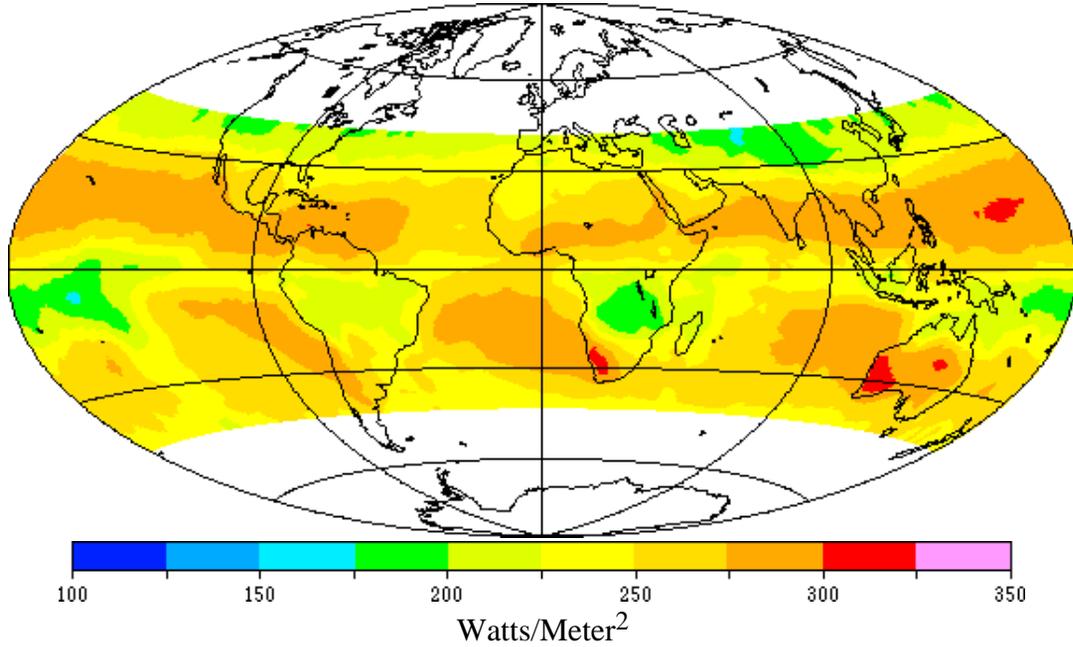
Longwave Radiation from CERES ERBE-like Processing

TRMM January 1998 ES-4

Processed: 1998/10/01

2.5-deg Equal Angle

Monthly Mean (Hour)



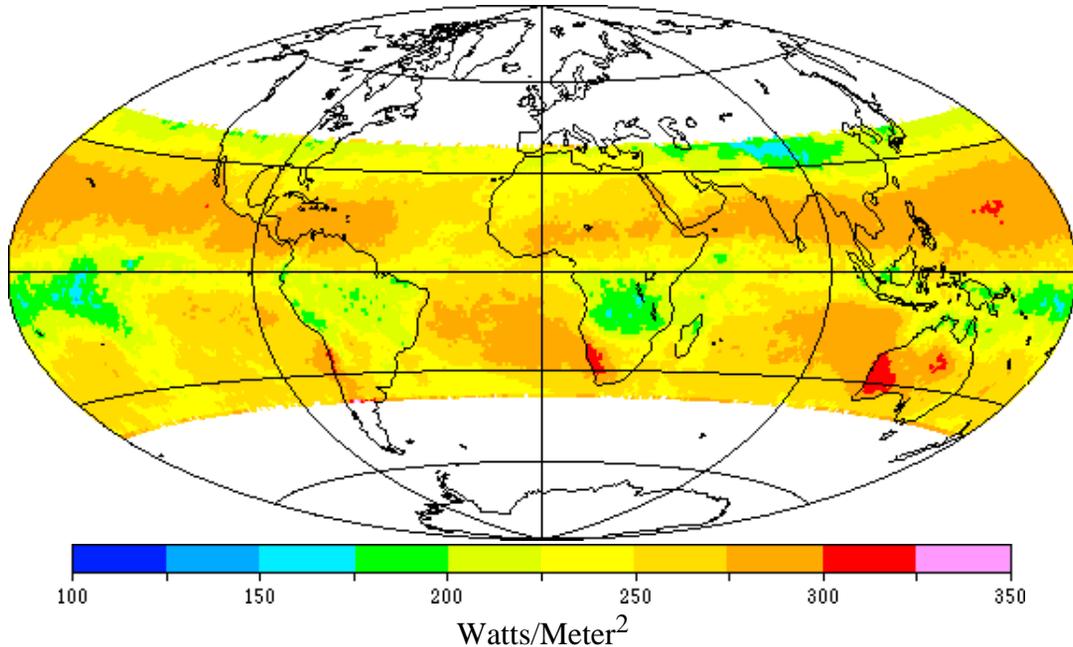
Longwave Radiation from CERES TISA Processing

TRMM January 1998 SRBAVG

Processed: 1999/05/20

1-deg Equal Angle Nested

Monthly Mean (Method A)



ERBE-Like QC graphics and reports available on the web

Netscape: CERES ERBE-like Data Validation

File Edit View Go Communicator Help

Back Forward Reload Home Search Guide Print Security Stop

Location: http://lposun/~dms/cdval/HTML/cdval_top.html

ERBE-like Data Validation for CERES ES-8

Year: 1998
Month: Aug
Day: 21
Instrument: TRMM AM1 PM1

Parameter: **TOT Filtered Radiance**
SW Filtered Radiance
WN Filtered Radiance
SW Unfiltered Radiance

ERBE Scene ID
 Standard
 Highlighted Coast
 Others

Fixed Color Scale
 Color Scaled to Data

Show Plot

Scene Identification from CERES ERBE-like Processing

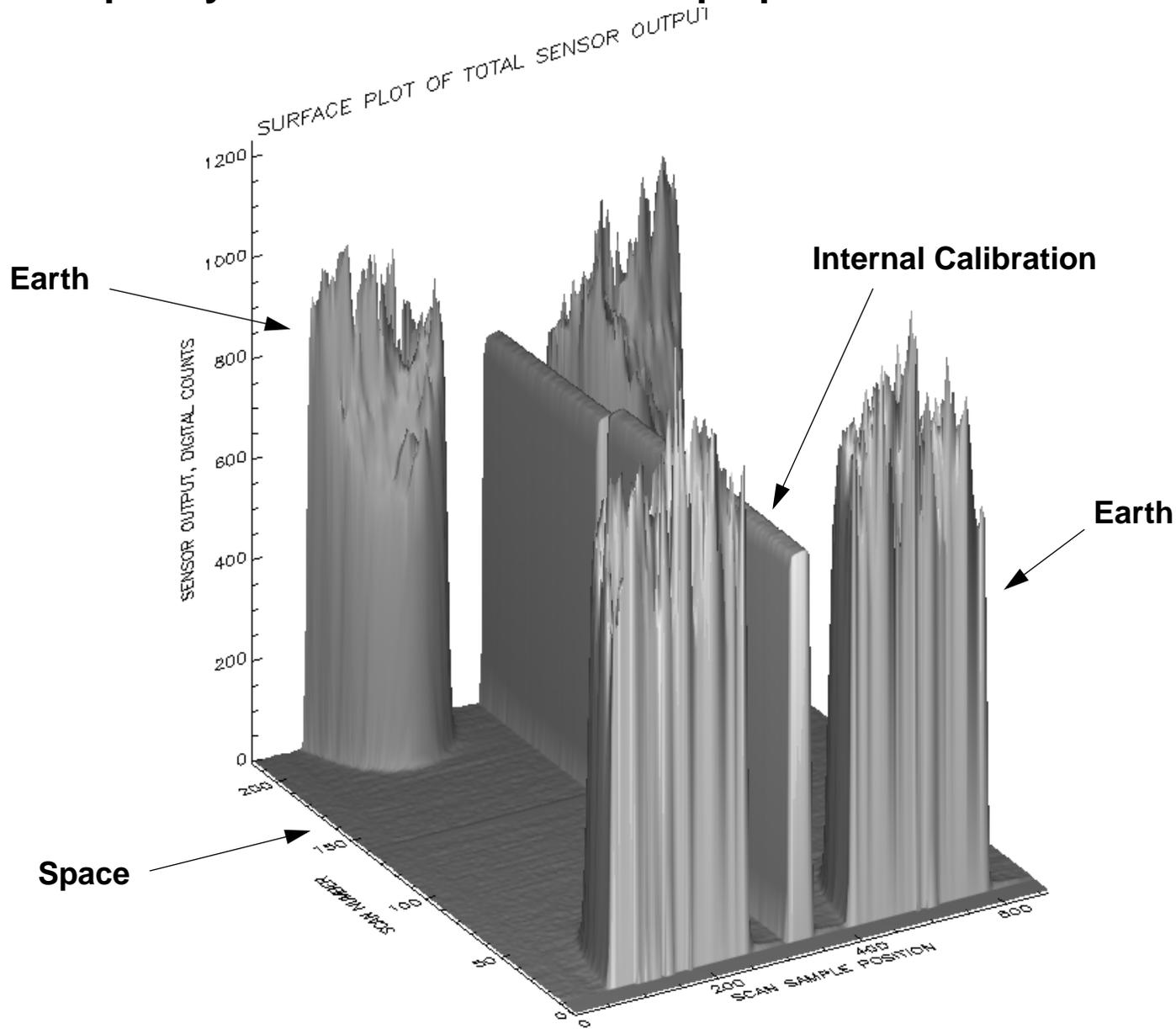
Processed : 1998/08/23 Measurement Level Instantaneous
File : CER_ES8B_TRMM-PFM_Ed1-QC_008000.19980821 00:00 - 23:59

Ocean Land SNOW Desert Coast Ocean Land Coast Ocean Land Coast Overcast UNKNOWN
Clear Skies Partly Cloudy Mostly Cloudy

Shows RAPS, Crosstrack, Alongtrack

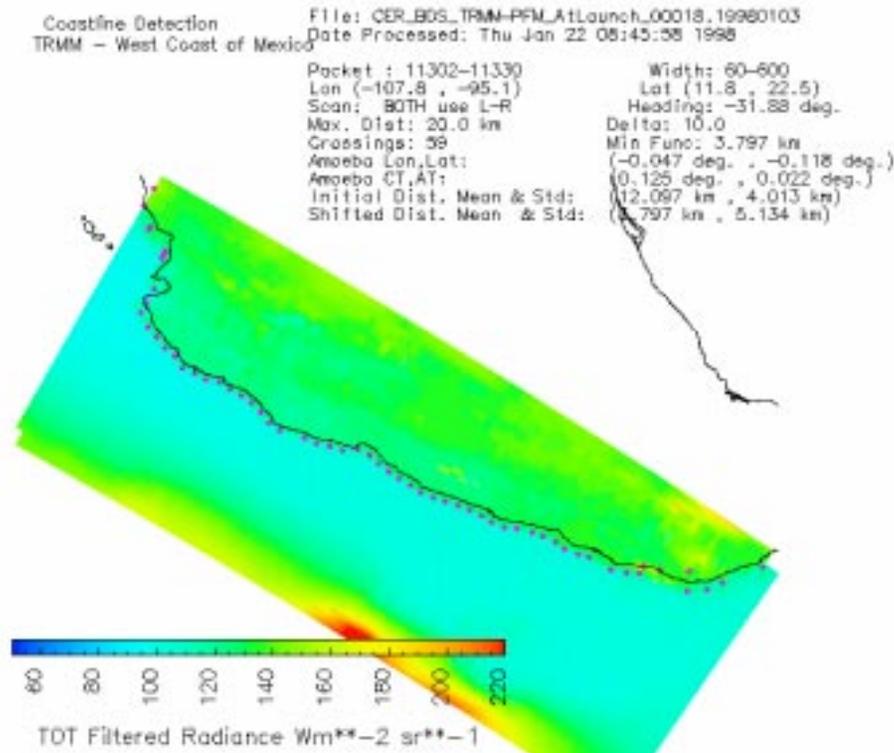
Home Validation Graphics Data Listings QC Analysis Tools Help

Offsets quickly derived from TRMM Deep Space Calibrations - 1/7-8/1998



- Six orbits over two days with about 10 minutes of usable scans in each operating mode
- Preliminary offsets derived within 4 days for use in operational processing

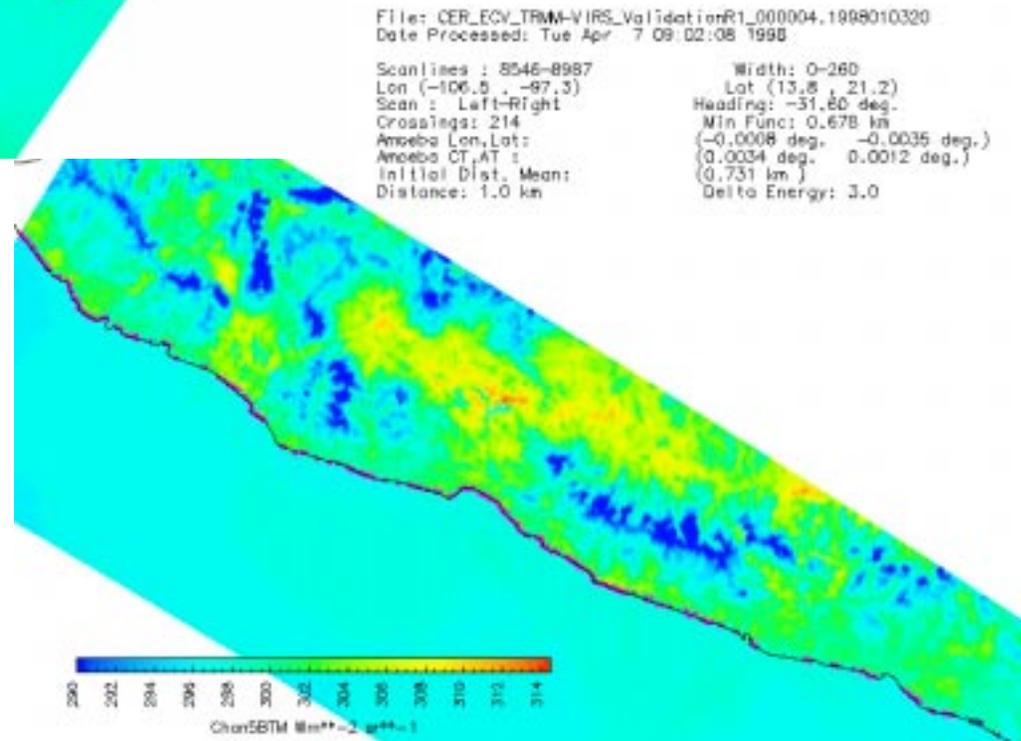
DX used for CERES and VIRS geolocation validation



- Initial results showed bias due to geocentric vs. geodetic latitude
- Part of investigation showed sunrise/sunset perturbations in TRMM attitude angles
- Thorough study of all factors in geolocation calculations demonstrated excellent accuracy

Simultaneous VIRS passes used to screen CERES results

Coastline detection for VIRS shows accurate location



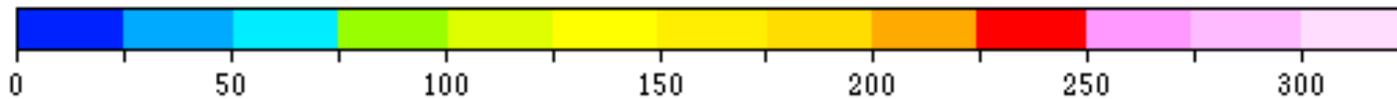
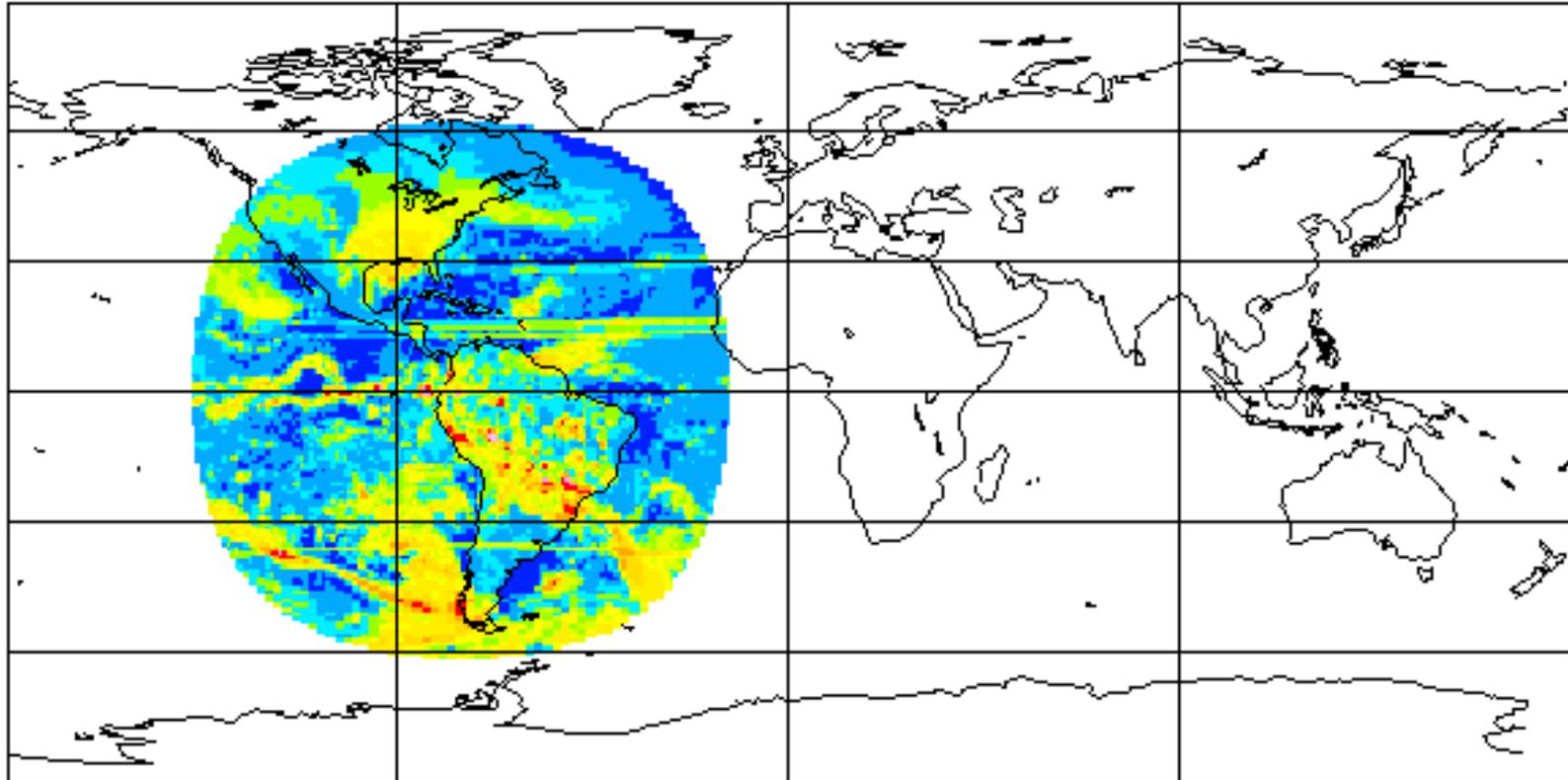
Mean Visible Radiance From CERES Processing

GOES-8 January 1998 GGEO

Processed: 1998/08/31

1-deg Equal Angle Nested

Day: 07 Hour: 19



Watts/Meter²/sr¹

GOES-8 Streaks -- Uncorrected

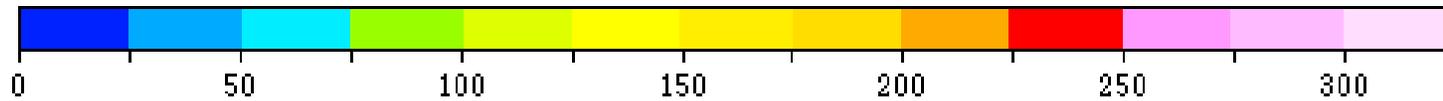
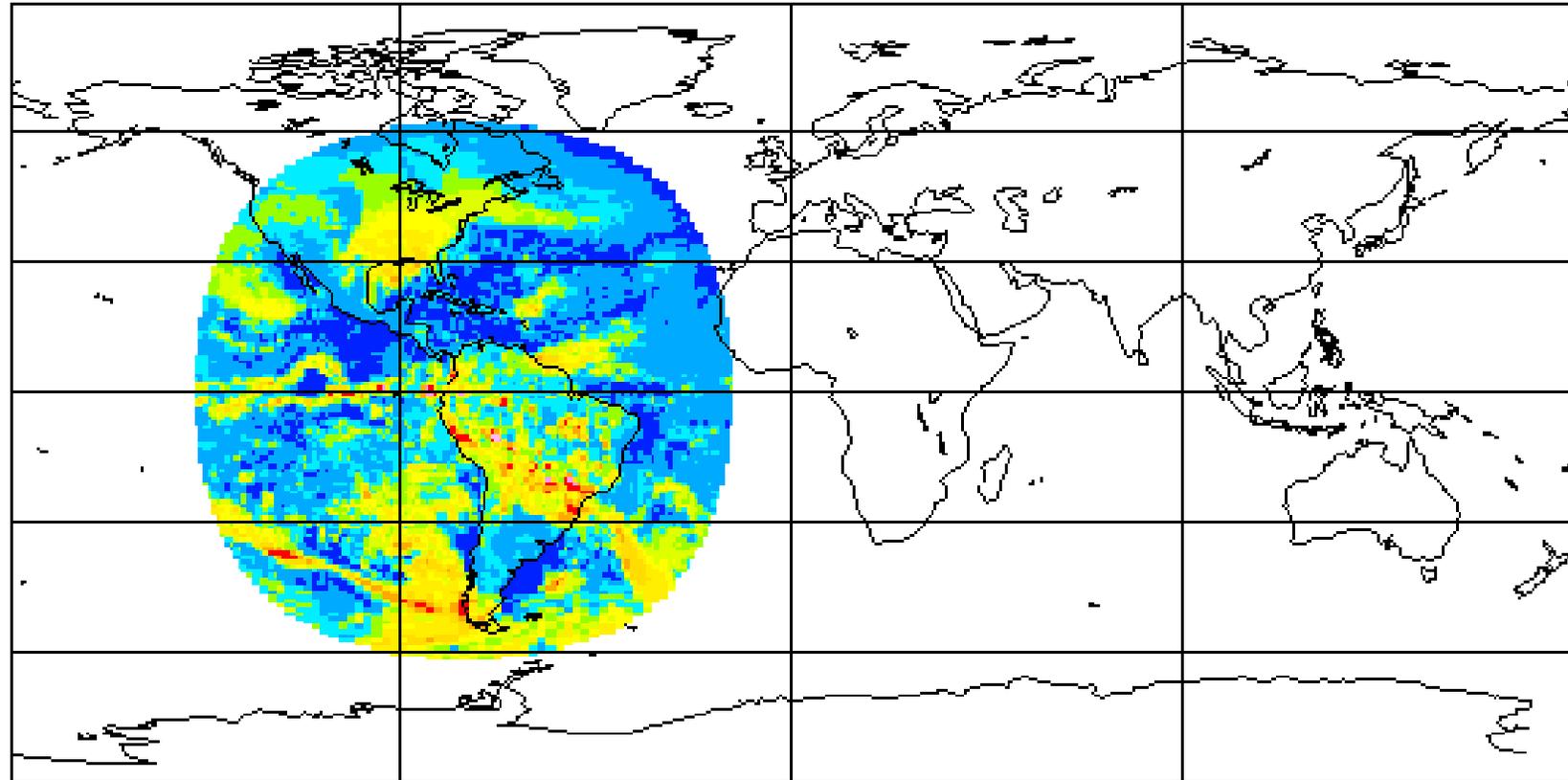
Mean Visible Radiance From CERES Processing

GOES-8 January 1998 GGEO

Processed: 1998/08/28

1-deg Equal Angle Nested

Day: 07 Hour: 19



Watts/Meter²/sr¹

GOES-8 Streaks -- Corrected

CERES Post-Launch DAAC Production Measurements - 05/26/99

One execution on LaTIS configuration of each PGE for actual production of January 5, 1998 (Hr 00 if hourly) TRMM data.

SS	PGE	Compiler	Date	Time, sec			Block I/O		Mem ory, MB	Disk Storage, MB			Run per Mon
				Wall	User	Sys	In	Out		In	Int	Arc	
1.0	Instrument (1.1P1)	Ada	05/03/99	19802	17525	197	22551	6637	32	105	864	886	31
	Instrument (1.2P1)	Ada	05/03/99	1011	72	15	1989	2	318	864	0	276	31
2.0	Snow Map Gen. (2.1P1)	SGIF90	09/29/98	85	69	4	1066	14	45	66	0	0.05	1
	Daily TOA Inversion(All)	SGIF90	09/29/98	6810	4125	2042	40435	1005	74	276	0	959	31
3.0	Monthly Averaging (All)	SGIF90	10/01/98	767	613	132	12466	469	52	670	0	199	1
4.1-4.4	Surfmap (4.1-4.0P1)	SGIF90	03/16/99	3	2	1	39	1	67	2	0	5	31
4.1-4.4	Cld Ret/Ftprnt (4.1-4.1P1)	SGIF90	03/17/99	8583	8098	84	27949	27	465	313	757	361	744
4.1-4.4	CRH Update (4.1-4.2P1)	SGIF90	03/17/99	73	28	19	2727	3	186	9	0	19	31
4.5-4.6	TOA/Surf Flx (4.5-6.1P1)	SGIF90	03/18/99	1536	290	1159	3046	8	4	194	0	180	744
4.5-4.6	TOA/Surf Flx (4.5-6.2P1)	SGIF90	03/18/99	62	10	8	2901	5	16	186	0	183	744
5.0	Inst. SARB (5.1P1)	SGIF90	03/27/99	10298	10130	62	2895	1	24	245	0	245	744
5.0	Inst. SARB (5.2P1)	SGIF90	03/27/99	131	17	17	3787	2	19	245	0	249	744
7.2	Synoptic SARB	SGIF90											
12.0	MOA Regridding (12.1P1)	NAG32	02/24/99	1265	1200	47	35946	26	75	93	0	320	31

CERES Post-Launch DAAC Production Measurements - 05/26/99

One execution on LaTIS configuration of each PGE for actual production of January 5, 1998 (Hr 00 if hourly) TRMM data.

SS	PGE	Compiler	Date	Time, sec			Block I/O		Memory, MB	Disk Storage, MB			Run per Mon
				Wall	User	Sys	In	Out		In	Int	Arc	
6.0	Synoptic Gridding (6.1P1)	NAG32	08/26/98	66	16	29	4203	3	89	6004	1	0	744
6.0	Sort FSW Files (6.2P1)	NAG32	08/28/98	719	220	289	41774	75	499	2970	0	2114	1
6.0	FSW HDF (6.3P1)	NAG32	08/28/98	1098	640	436	32300	52	138	2114	0	2110	1
9.0	Post MOA (9.1P1)	NAG32	03/24/99	26501	14122	9358	181734	3	397	9920	0	5764	1
9.0	Surface Gridding (9.2P1)	NAG32	03/25/98	3128	2999	76	4399	2	174	6124	3	0	744
9.0	Sort SFC Files (9.3P1)	NAG32	03/29/99	746	230	331	26821	71	497	2232	0	1682	1
9.0	SFC HDF (9.4P1)	NAG32	03/29/99	1049	548	431	24060	29	260	1682	0	1666	1
11.0	Grid GOES-8 (11.1P1)	NAG32	03/04/99	85886	84942	168	32370	3	31	2125	172	0	1
11.0	Grid GOES-9 (11.1P2)	NAG32	03/04/99	87198	86146	197	41848	2	805	2740	183	0	1
11.0	Grid GMS (11.1P4)	NAG32	03/04/99	71580	70801	158	17919	2	26	1272	185	0	1
11.0	Grid Meteosat (11.1P3)	NAG32	03/04/99	76873	76013	153	18275	3	24	1180	185	0	1
11.0	Sort GGEO (11.2P1)	NAG32	03/05/99	21706	16309	5136	5390	5749	1493	731	0	496	1
7.1	Synoptic Interpolate	NAG32											
8.0	Synoptic Averaging	NAG32											
10.0	TOA/SRB Averaging	NAG32	04/08/99	19694	15815	1876	83722	84	626	2754	0	2412	1

Some PGE's will require substantially more resources for each instrument on Terra and EOS-PM

CERES Post-Launch Processing Time Summary - 5/99

Number of wall-clock hours required to run one month of data through each subsystem

SS	PGE	Runs per Mon	Pre-Launch		TRMM Post-Launch			Terra/PM Factor
			Rel 1 9/96	Rel 2 10/97	4/98	9/98	5/99	
1.0-3.0	Instrument/ERBE-like	31	83	134	175	176	238	2
4.1-4.4	Clouds/Convolution	744	1687	952	1351	1143	1775	12
4.5-4.6	TOA/Surface Flux	744	12	30	(30)	281	330	2
5.0	Instantaneous SARB	744	10731	5611	(5611)	3391	2155	2
6.0	Atmospheric Gridding	744	789	124	(124)	14	14	2
7.2	Synoptic SARB	248	187	(187)	(187)	(187)	(190)	2
9.0	Surface Gridding	744	786	108	(108)	17	654	2
11.0	Grid Geostationary	5	4	(4)	(4)	96	95	1
	Remaining PGE's		7	94	(94)	(94)	(17)	2
Total hours for one month of data			14286	7244	7684	5399	5469	(28562)

- Release 1 measurements scaled from R8000 to R10000 chips and NAG to SGI compilers
 - The LaTIS computer used for CERES processing has capacity for TRMM & Terra, not PM
- () - Estimated

Benefits of TRMM and Terra End-to-end Tests with Operating Instruments

TRMM conducted three: Sim #1 (11/96), Sim #2 (5/7-9/97), Sim #3 (6/11-13/97)

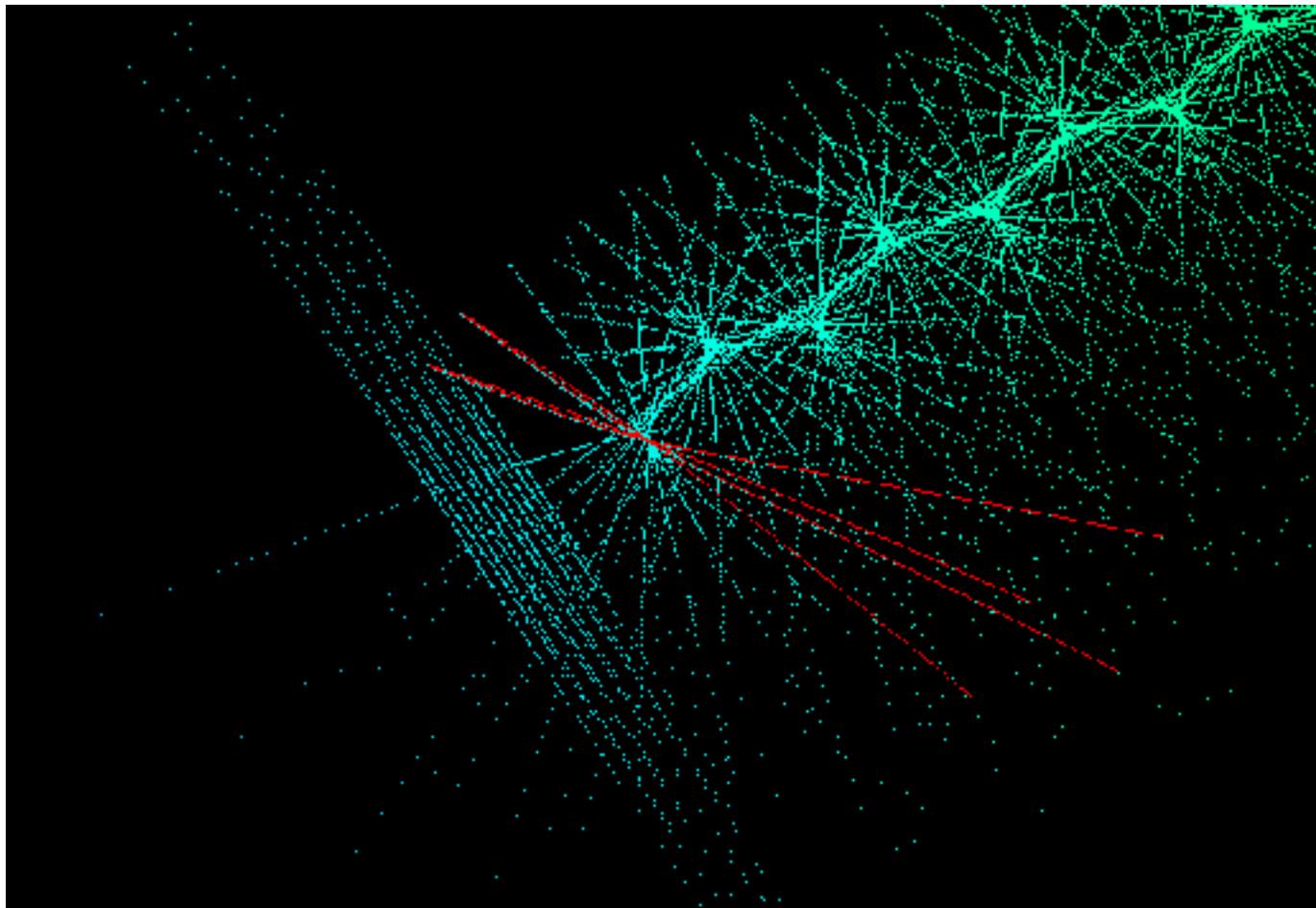
Terra has two so far: Valley Forge (3/30-31/99), Vandenburg (5/24-26/99)

Tests of interfaces, operating procedures, hardware, software and personnel

Examples of lessons from Terra tests:

- Requested, generated, delivered, and processed:
 - planning aids
 - housekeeping data via time-ordered downlink files
 - expedited data sets
 - instrument production data sets
 - science products to SCF
- Clarified operational commanding issues
 - identified and corrected errors in planning aids and sun-avoidance zones
 - found constraint violations with multiple instrument operations, to be fixed
 - developed and tested command scenarios for deep space calibrations
- Found and fixed CERES hardware and software problems
 - FM1 short-scan profile corrected by TRW patch loaded at power-on
 - Improvements in geolocation technique to handle large data gaps

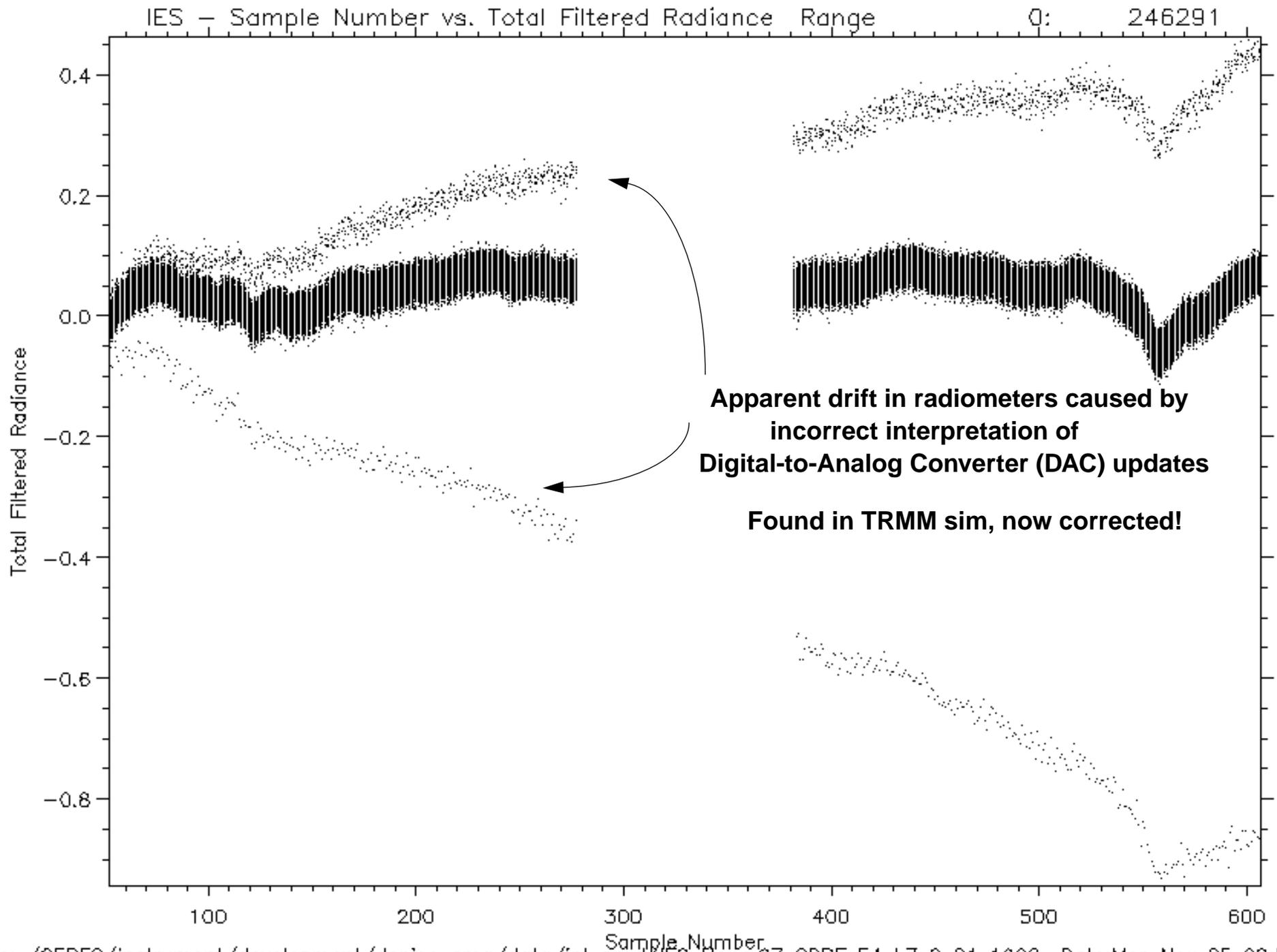
BDS Release 2 Visualization - FAPS Normal Scan to RAPS Short Scan
File: CBDS_A1_54_19980220_19970317



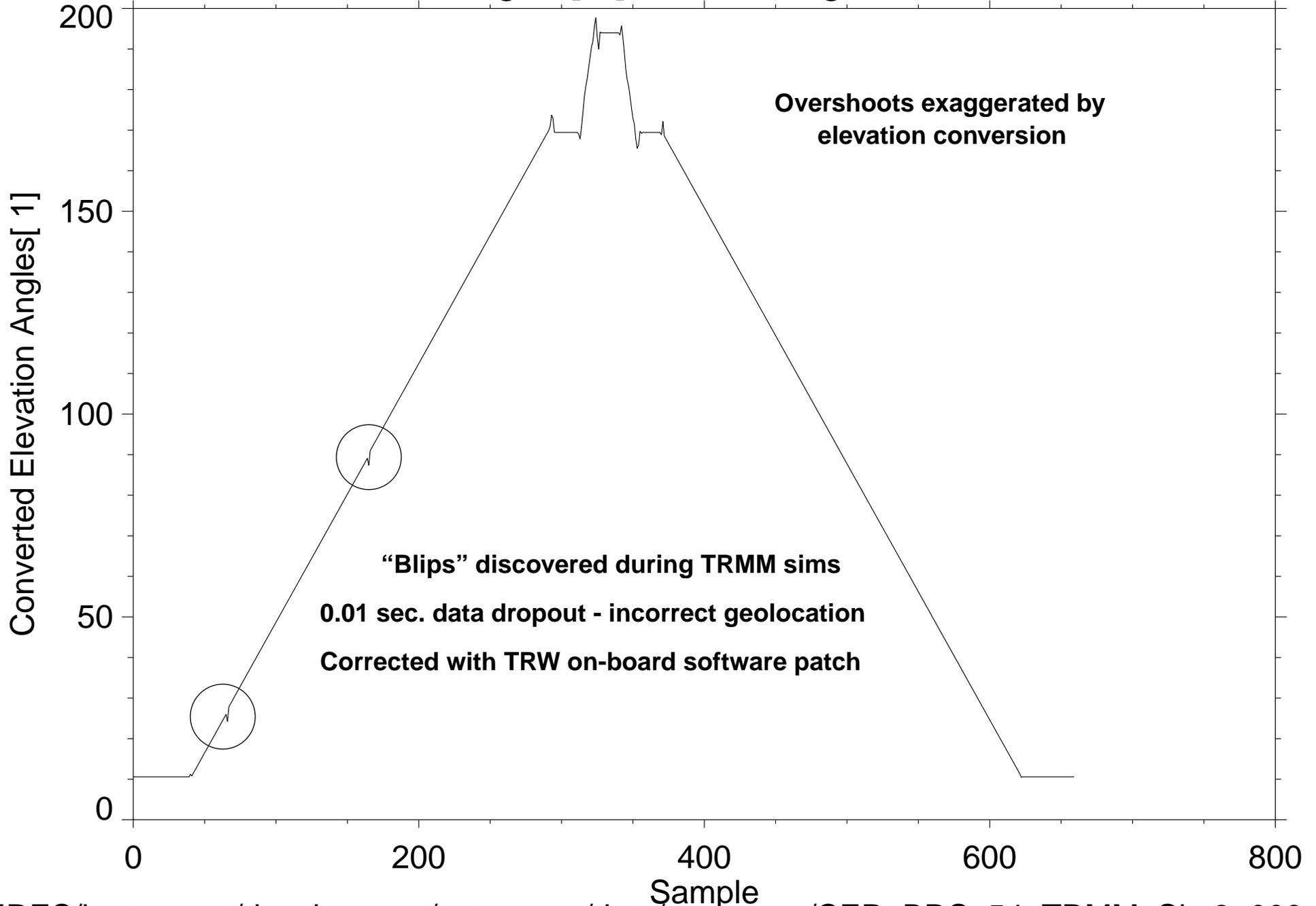
Transition from cross-track to RAPS mode caused geometry errors detected by visualization - now corrected

Data from CERES PFM instrument during TRMM Mission Simulation #1 - November 1996

Multiple scans of contamination covers

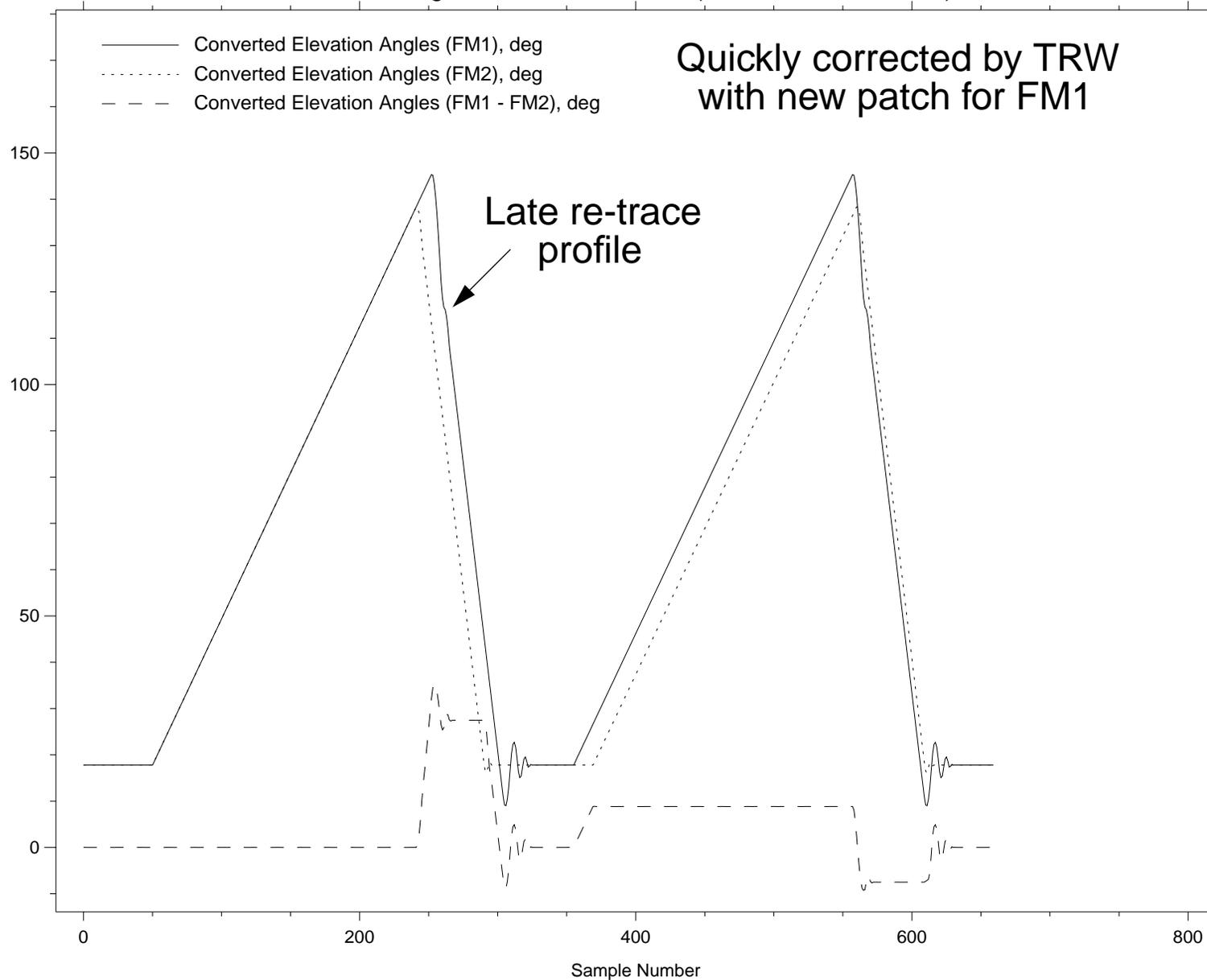


Converted Elevation Angles[1] Data Range: 1636: 1637: 1 0: 660: 1



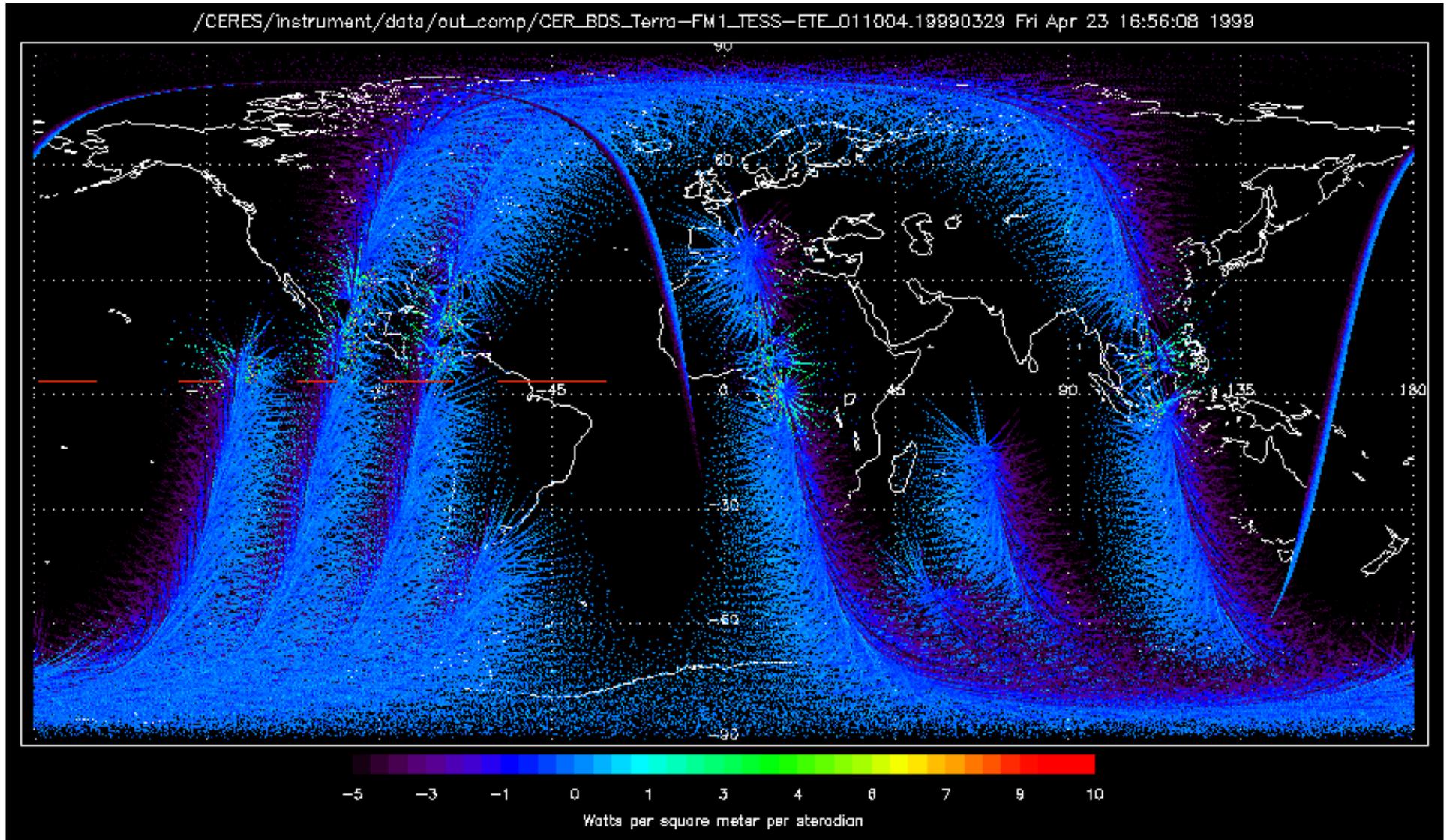
Short-scan profile discrepancy found during Terra ETE test

Data Range: 07:13:08 - 07:13:08 (500: 500: 1; 1: 660: 1)



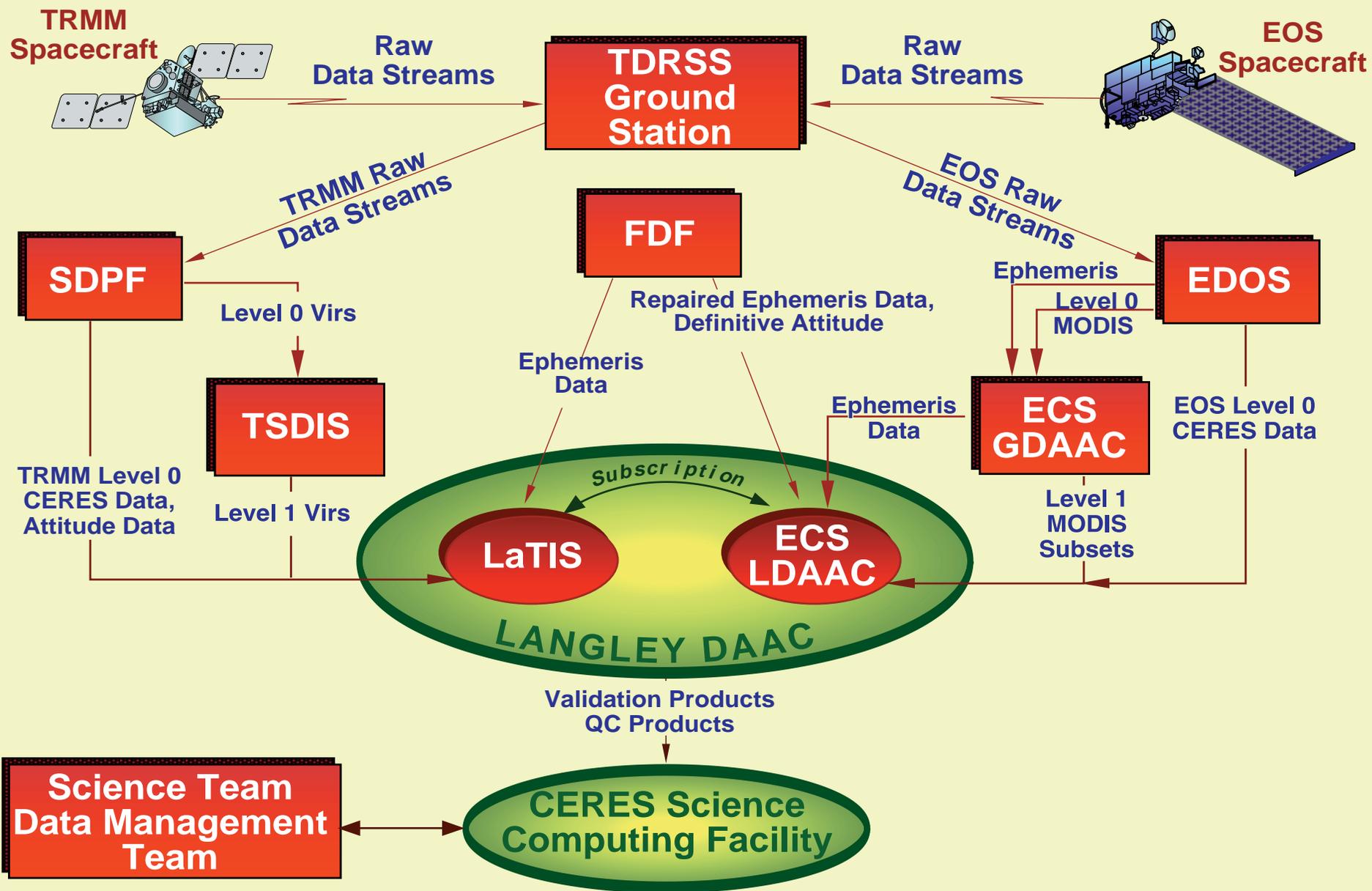
Total filtered radiance - RAPS and Along-Track scan mode on Terra

Received and processed on LaTIS 4/23/99 during Terra End-to-end Science Simulation

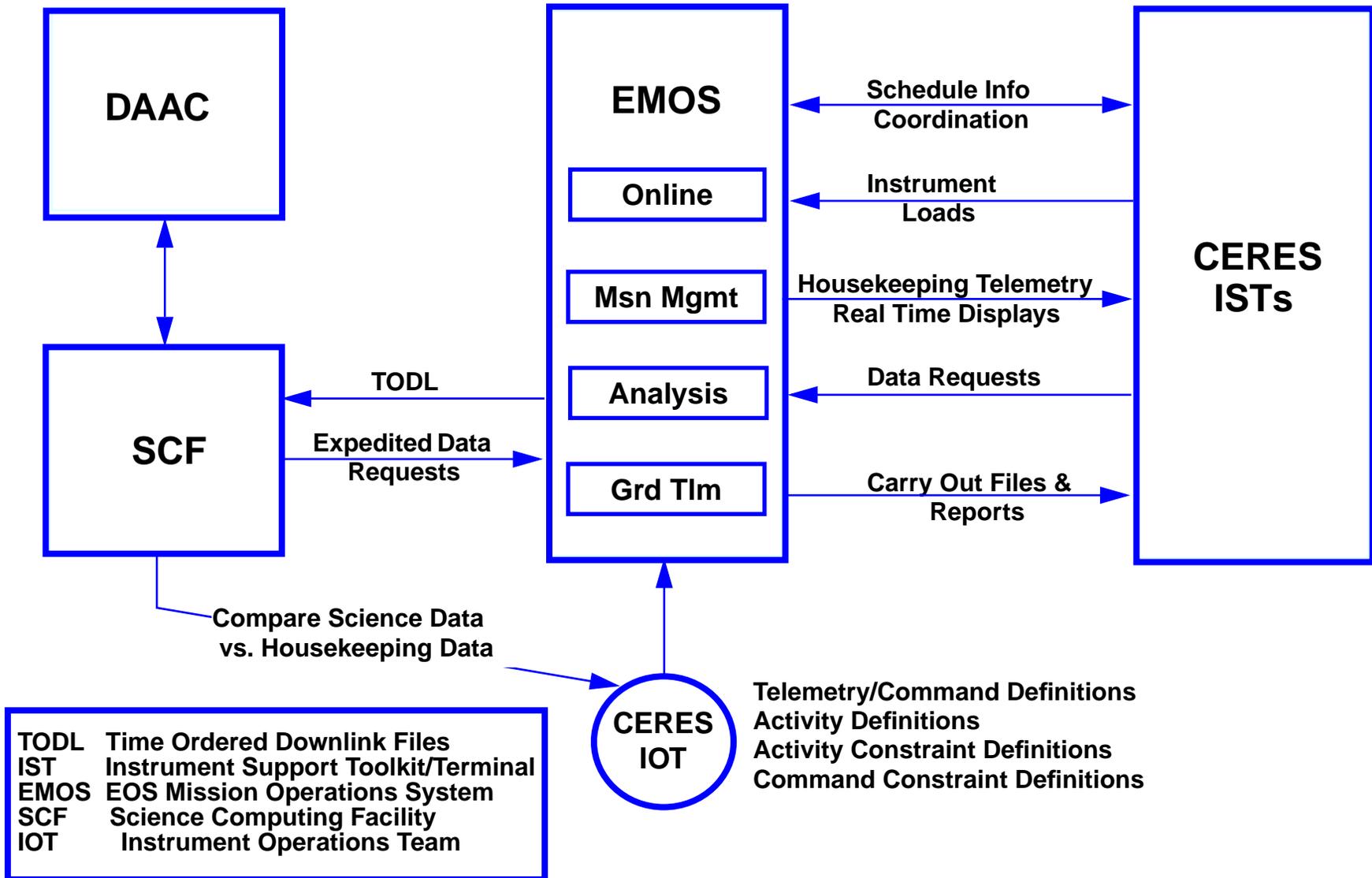


Scanning contamination covers so little variation in radiance. Note short-scan sun avoidance zones.

Flow of Instrument and Platform Ancillary Data from TRMM and EOS Platforms



CERES EMOS Interface with IST/SCF



CERES Interface Requirements

Level 0 instrument data sets

24 hours UT midnight to midnight - separated by APID

File names which include APID, data date (not production time) and version

Ephemeris/Attitude

Period corresponding to 24 hour Level 0 plus previous, next period

- TRMM: 24 hours in one file [3 files per day]

- Terra: 2 hours in one file [14 files to run]

Flight Dynamics attitude used for TRMM and Terra

Compatible with DPREP for Toolkit geolocation

Already have two different versions of DPREP - pick one

Angular and spatial accuracy derived from requirement to co-locate all MODIS pixels within a given CERES footprint.

Implies geolocation accuracy to less than 1/2 MODIS field of view. Not very stringent compared with other instruments.

LANGLEY RESEARCH CENTER

APPROVAL: _____
J.F. Kibler

ACCOMPLISHMENT _____

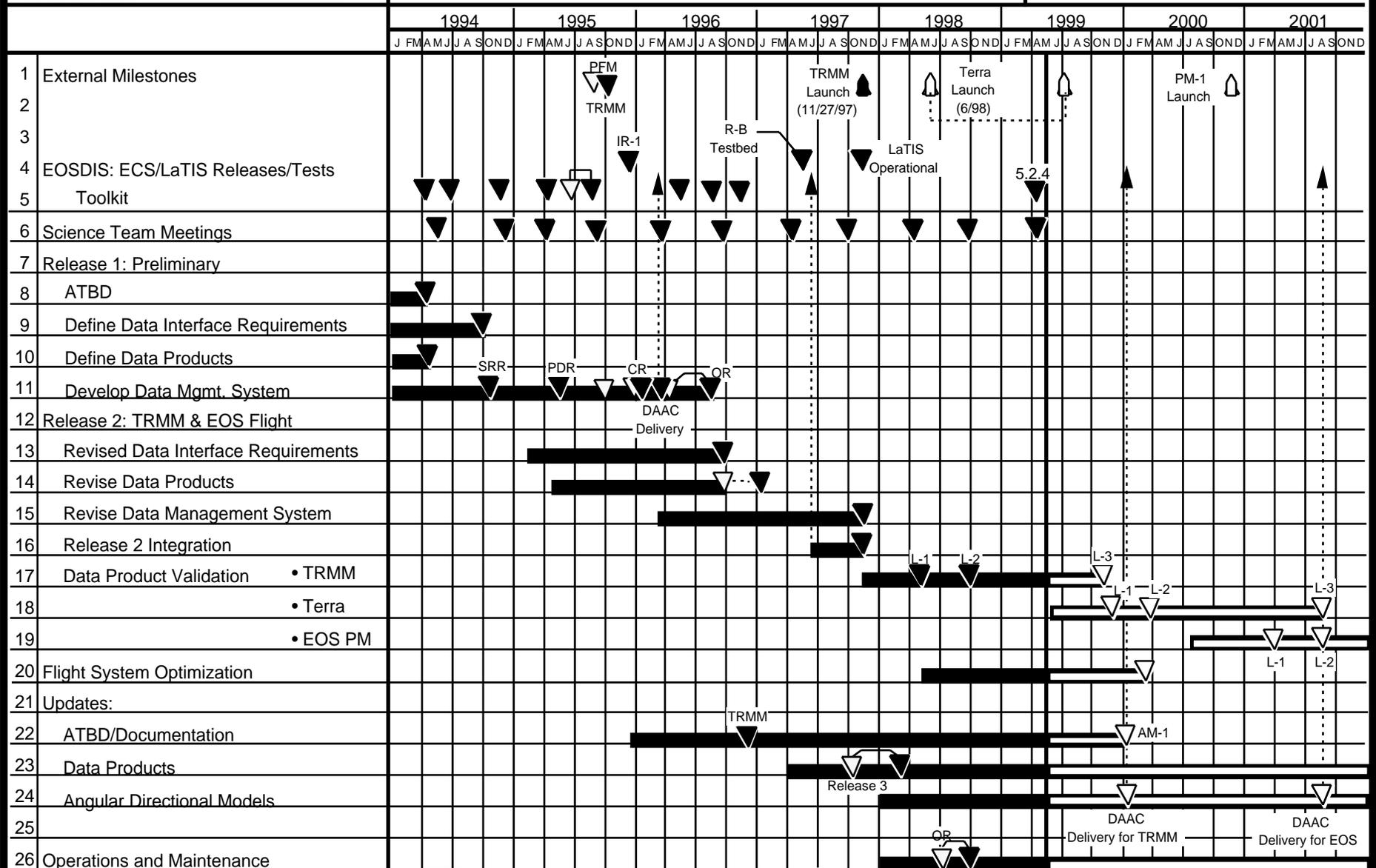
CERES Data Management System Development

LEVEL

ORIGINAL SCHEDULE APPROVAL 10/8/92

LAST SCHEDULE CHANGE 5/25/99

STATUS AS OF 5/25/99



KEY:
 CR: Code Reviews
 ATBD: Algorithm Theoretical Basis Documents
 OR: Operations Reviews
 SRR: Software Requirements Reviews
 PDR: Preliminary Design Reviews
 L - # : Level 1, 2, & 3 Data Products

CERES Issues for Discussion

Minimize differences in data interfaces - make them same as TRMM or Terra

Data flow from EDOS/GDAAC to LDAAC - reliable, timely and complete

DPREP compatibility with geolocation Toolkit

Keep MODIS Level 1B interface the same as Terra

End-to-End simulations and tests are critical [early and often]

Big help if:

- real instruments operating in flight modes
- through real interfaces
- with real data products coming from science software

Spacecraft integration and test data through EDOS to DAAC for early testing

Actual Level 0, simulated ephemeris and attitude

Actual MODIS Level 1B data product in post-launch format

Early versions of operational planning aids, real-time files

Timeliness of IST deployment - needed at first ETE test

Allow expedited data request (for anomaly investigation) after EDOS receipt

Sufficient time during deep space calibration for all in-orbit operating modes

Some URL's

Note that the Langley network firewall is changing the access to some services

PDF version of status presentations

- http://asd-www.larc.nasa.gov/ceres/science_team/quart_rept.html

CERES TRMM Quick-look Results

- http://asd-www.larc.nasa.gov/ceres/trmm/ceres_trmm.html

Instrument Operations and Housekeeping Data Statistics

- http://earth-www.larc.nasa.gov/ceresweb/instr_pub.html

ERBE-like Public Web Page

- http://earth-www.larc.nasa.gov/erbelike/pub_cdval/

SARB Working Group

- <http://srbsun.larc.nasa.gov/sarb/>

Surface Properties

- http://tanalo.larc.nasa.gov:8080/surf_htmls/SARB_surf.html

On-Line documentation - links to all CERES documents, data product collection guides

- <http://asd-www.larc.nasa.gov/ceres/docs.html>

Langley DAAC - has link to CERES data order tool and can download viewHDF

- <http://eosweb.larc.nasa.gov/>